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OUR WORK.

House of Education, Ambleside.—The term begins on September 29th. The new students are apparently a very promising set. Some of the ladies entering, especially the foreigners, are remarkably good linguists.

Mothers' Education Course.—The examination of the "Mothers'" papers is one of the most interesting and delightful of our duties. We feel that in this Course we are training mothers for service in the P.N.E.U. as well as for their more immediate duties.

Some of the work sent in is very admirable, showing thorough study, practical power and observation, coupled with that peculiar gift of handling children which belongs specially to mothers.

We hope to get good writers and speakers from the M.E.C.

It is matter of great regret that all mothers who receive the syllabus do not work the examination papers.

We are glad to receive the most indifferent work, knowing how soon improvement will be manifest.

Parents' Review School.—It has been pleasant in the holidays to meet various groups of children who are doing good and happy work in the school.

It would be very nice to see all our children! Who knows! Some day even this may be accomplished.

THE
PARENTS' REVIEW
A MONTHLY MAGAZINE
OF HOME-TRAINING AND CULTURE.

"Education is an atmosphere, a discipline, a life."

"THE ART OF BREATHING AS APPLIED TO PHYSICAL DEVELOPMENT."

By A. L. HOPER DIXON, Surgeon-Captain, A.M.S.

Lecture delivered at the Royal United Service Institution.

THE purport of my paper is to show the relationship which exists between the correct process of respiration and the physical development of the chest. But prior to discussing this question I must briefly occupy your attention in demonstrating, from an elementary point of view, the anatomical and physiological aspects of the parts concerned.

The trunk of the body consists of two cavities, an upper thoracic—(the chest)—and a lower abdominal—the belly. The higher chamber contains the lungs, heart, and great blood-vessels, that is the circulatory and respiratory apparatus, and the lower the stomach, liver, kidneys, and intestines; in other words, the organs of digestion, nutrition, and elimination. Interposed between these is the diaphragm, which is by a long way the most important muscle concerned in respiration.

This muscle forms a contractile curtain and separates the chest above from the abdomen below.

The chest is conical in shape, narrow and immobile at its upper part, broad and expansile below.

Above, in addition to supporting the neck, it provides passage for the large blood-vessels, the wind-pipe, and gullet. In front is the upper portion of the breast-bone, laterally the first ribs, and behind is the spine. The middle portion of the chest has the breast-bone in front, ribs on either side, and the back-bone posteriorly. The floor of this cavity is formed by the diaphragm. There are twelve ribs on either side, which, with the breast-bone in front and spine behind, serve to form the bony framework of the chest. These ribs are elastic in action, on account of the cartilage interposed between them and the breast-bone, and are arched in form. Behind they are attached to the back-bone and in front to the breast bone by means of cartilage which provides considerable elasticity.

The ribs increase in length from the first to the seventh after this they diminish. The seventh rib would probably be the most mobile and the first the most immobile. Their direction is oblique and the interposing spaces are termed "intercostal."

I now come to the diaphragm. This is a muscle whose importance cannot be overestimated.

It forms a floor for the chest, supporting the lungs and heart, and a roof for the abdomen. It is like a dome in shape and undergoes changes in form during respiration, which I will describe later on.

It is attached to the internal circumference of the chest, to the lower portion of the breast-bone in front (ensiform cartilage), to the six or seven lower ribs on the sides, and to the back-bone behind.

So far as the muscles of the chest are concerned it would have no bearing on this paper to discuss them in detail; suffice it to say that the ribs are laced together by two sets of muscles termed "intercostal," which severally play their parts in the process of respiration.

I now come to the physiology of these parts. The lungs are the most important structure and fill up for the most part the cavity of the chest, of which they take the shape, that is, roughly pyramidal or sugarloaf, with the narrow portions above and the bases below.

They are united by the wind-pipe which bifurcates a little below the root of the neck.

They consist for the most part of air-cells, with a rich supply of small blood-vessels. The amount of air-cells is calculated as about 725 millions. The right lung is larger than the left on account of the latter having to make room for the heart.

For the sake of analogy the lungs may be compared to two large sponges capable of absorbing atmospheric air, as sponges would water, and then discharging, by virtue of their elasticity, the impure carbonic acid gas. This alternate expansion and filling with pure air and contraction with emptying of impure air constitutes the process of "respiration" and the extension to which it is done is termed the vital capacity.

The effects of respiration are twofold:—Firstly, to introduce oxygen into the system, which is necessary for the maintenance of life, and, secondly, to get rid of substances, the products of combustion, which, if allowed to be retained, would poison the system. Inspiration fulfils the first requirement and expiration the second. So far as inspiration is concerned, the enlargement of the chest is entirely muscular, and the diaphragm is the most important muscle which provides for this increase of dimension. Every time we breathe the diaphragm contracts, has a tendency to become flat, pushes down on the abdominal organs, and thereby elongates the vertical diameter of the chest. The increase in the transverse diameter of the chest is due to rib expansion and the antero-posterior diameter of the chest is increased by the ribs pushing the breast-bone forward. Expiration on the other hand, is not a muscular act. For when the inspiratory act is over, everything flies back to its original position. This is due to elastic recoil aided by the weight of the chest; and, at the same time, the pressure on the abdominal organs is relieved by the withdrawal of the diaphragm.

So much for the anatomy and physiology. I now pass on to the pith of my paper, which professes to show how breathing properly applied, may effect the physical development of the chest.

I have shown how the chest may be increased in three diameters, namely, from above downwards, from before backwards, and sideways, and I now intend to give you a practical demonstration of correct and incorrect methods of taking one's breath. These may be easily observed from the exterior. (1) Upper chest or collar-bone and shoulder breathing, (2) mid-chest or rib breathing, and (3) abdominal or diaphragmatic breathing.

These movements are to some extent dependent on each other.

I will first take the incorrect mode of breathing. This consists in filling the upper and middle portions of the lungs with air partially at the expense of the lower.

I take an inspiration, my collar-bone and shoulders are raised, so also are the upper chest and top of the breast-bone, there is a slight movement upwards and outwards of the ribs, whilst the lower portion of the lungs remain passive. The diaphragm is only exercised to a feeble extent, and the abdomen, released from diaphragmatic pressure, shows a concave surface instead of convex. This mode of breathing is practised by the majority of people, both male and female, when asked to do a respiratory gymnastic, but is never practised during sleep, and I have no hesitation in stating it to be entirely wrong. I have already described to you the narrow limits and immobility of the upper portion of the chest, where the lungs in that quarter are imprisoned in a bony, inelastic box, in close opposition to the wind-pipe, gullet, and large arteries and veins, so it is not inconsistent to suppose that this form of breathing must not only exercise undue pressure on the subjacent parts, but also cause imperfect aeration of the blood.

I have frequently seen both amateur and professional singers grow scarlet in the face whilst singing, owing to their employing this upper chest form of breathing, and thereby causing congestion of the vessels already referred to.

So far as my experience of the recruit goes, he does the same thing. He has not the slightest notion of filling his lungs. He is told to take a deep breath, and replies by raising his collar-bones and hunching up his shoulders. In other words, he makes an exaggerated effort of his usual mode of breathing.

The result is that his chest expansion must be very small I have frequently met recruits with less than one inch chest expansion, and some only half an inch.

I now come to the second mode of breathing—mid-chest or rib. This consists in the expansion of the middle and lower portions of the chest, principally in the transverse and antero-posterior diameters, which is accomplished through the medium of the ribs. The latter are drawn forwards, outwards, and slightly upwards, and the breast-bone is pushed forwards. *This mode of breathing does not stand out separately by itself as an independent act*, but coexists either with the incorrect method of upper chest breathing, or the correct style of abdominal or diaphragmatic breathing. On the other hand, this costal respiration may be practised in a perfectly independent manner, without encroaching on the upper chest above or the abdomen below, only by people who have made a practical study of the subject.

I will now show you the middle chest or rib form of breathing, and you will notice that it occurs quite independently of the collar-bones above and the abdomen below. But this act, as an independent one, is a physical impossibility to those who have not trained their respiratory muscles.

The third and last method of breathing is the abdominal or diaphragmatic. *This is the correct form of breathing*, and is assisted by the ribs.

I have already explained to you that the diaphragm forms a domeshaped partition between the chest above and the abdomen below, and resembles in a quiescent state an expanded parachute.

The convexity is towards the chest and the concavity to the abdomen. Directly we take a deep breath the diaphragm descends and flattens out at the sides, so pressing down the abdominal organs below; and, as a consequence of this, the exterior surface of the abdomen naturally assumes a rotund convex appearance. Then, when expiration occurs, the pressure on the abdomen is released and its surface loses its roundness of outline as the result of the diaphragm flying back to its original position.

I wish to lay great stress on the shape of the abdomen during respiration, as it is a common occurrence to see people take an inspiration, hunch their shoulders up, draw in their abdomen, and then expire and puff their belly out, and they are under the impression that they are breathing correctly, whereas it is the exact opposite that should take place. In correct breathing there should be no movement of the collar-bones, or shoulders, but merely a forward and upward movement of the breast-bone, more especially the lower part, combined with rib movement already described and the alternate enlargement and diminution of the abdominal walls.

The reason why this diaphragmatic form of breathing should be cultivated is not difficult to understand when I draw your attention to the confines of the lungs.

I have already referred to the cramped condition of the parts above, and this is the extreme opposite of that below. Here, below, we have the broad bases of the lungs resting on and encompassed by soft and resilient structures. Here, the lungs have full play, and their movements are not hampered as they are above by close opposition to great blood-vessels and surrounded by an immobile casement of bone.

Mr. Lennox Browne who wrote "Voice, Song and Speech" in collaboration with the late Mr. Behnke justly insists that "the criterion of correct inspiration is an increase of size of the abdomen and of the lower part of the chest. Whoever draws in the abdomen and raises the upper part of the chest breathes wrongly.

"The lungs at their bases are surrounded by soft and yielding parts, which can be worked with the utmost ease, because nature has not placed any obstacle in their way; but, unfortunately, many people are continually doing this themselves." This work was written for the purpose of teaching the best method of inflating the lungs, with reference to songs and oratory, but the facts are equally applicable to my present subject. I may here take the opportunity of tendering my thanks to the author for many valuable hints on the subject.

I now intend to give you a practical demonstration of the means I employ for developing the chest and otherwise strengthening the body. I have brought with me, from Aldershot, three recruits of the Medical Staff Corps, who recently joined the depôt, and who have been permitted by their commanding officer to take advantage, under my tuition, of a short course of breathing drill. (In all these exercises the individual must be stripped of his upper clothing.)

Exercise No. I.—Recumbent position, head slightly raised, arms close to the side.

Gentle breathing is now practised, which is entirely confined to the ribs and diaphragm.

The extreme upper portion of the chest, together with the shoulders, remain quiescent. There must be no movement of

the collar-bones. For the purpose of resistance, a lightly diffused pressure, evenly distributed, is maintained over the seat of diaphragmatic action. This covering is made of a porous plastic material, which, after being moulded to the parts concerned, is fitted with weights, the total not exceeding $3\frac{1}{2}$ lbs.

Exercises Nos. II. and III. consist of the same exercise, sitting and standing respectively, only without the addition of weights.

Exercise No. IV.—The same position is assumed as in No. I. A full, deep inspiration is taken, the diaphragm is then fixed—this is done by holding the breath—and suddenly released by a forcible expiration.

Exercises Nos. V. and VI.—The same exercise, sitting and standing respectively, without the addition of weights.

Exercise No. VII.—Recumbent position. Take a full inspiration—when the diaphragm is well down and the abdomen protruded, fix the former—then say the first four or eight letters of the alphabet and suddenly expel the air.

Exercises Nos. VIII. and IX. are the same exercise, sitting and standing, without the addition of weights.

Exercise No. X.—Recumbent position. Take a full inspiration, and whilst doing so raise two light dumb-bells from each side over the head to a half-right angle with the shoulders; now complete the inspiration, then forcibly expire, and replace the dumb-bells in their original position.

Exercise No. XI.—The same as the previous exercise, only practised on a form. The head should be well raised.

Exercise No. XII.—Recumbent position. Take a quiet and prolonged inspiration through the nose, followed by a similar expiration through the mouth. During the latter place a finger close up to and almost between the lips, and endeavour to control the exit of air without warming the finger.

Exercise No. XIII.—Take a quiet, prolonged inspiration and then forcibly expire.

Exercise No. XIV.—Take a hurried inspiration and then slowly expire with the finger to the mouth, as in No. XII.

Exercise No. XV.—In the standing position, arms by side, with dumb-bell in each hand. Raise the dumb-bells at arm's length over the head during inspiration, and lower to side during expiration.

EXERCISE NO. XVI.—In the recumbent, sitting and standing positions. A series of light respirations at the rate of about 360 to the minute.

EXERCISE NO. XVII.—Take the hurried respirations as in the previous exercise for about five seconds, then a deep breath, and gradually expire.

I have now illustrated how a variety of exercises which, when practised regularly and in a careful manner, serve to educate the diaphragm in the various performances of its muscular duties. In order to develop any muscle it is necessary that there must be a certain amount of resistance. No muscle can be otherwise properly developed. For this reason I employ light weights with most exercises, but more especially those which are performed in the recumbent position. I find with my pupils that a slight pressure evenly distributed over the diaphragmatic area facilitates not only the method of explanation, but also the practical results. Here is a shield (produced) which I recently designed for this purpose.

The diaphragm is quite as easy to train, with proper care, as any other muscle in the body; but, strange to say, owing probably to its being out of sight, it is entirely neglected. No trainer in athletics appears to devote a thought to the subject. A man who goes in for fencing, boxing, or running, devotes his training to the muscles concerned in these respective exercises, irrespective of the diaphragm, and little dreams of the enormous benefit that may be derived from training his bellows and learning to control his wind. There are many advantages to be gained by training this most important muscle in the manner I have just demonstrated. These exercises are the means of thoroughly well airing the lungs, and therefore cause a corresponding increase of respiratory capacity. This is easily proved by means of a spirometer, when it may be seen that a man who breathes correctly will have no difficulty in outrivalling a man who hunches up his shoulders every time he inspires.

They have a most beneficial effect on the general health and digestive powers, which is in great measure due to the increased oxygenation of the blood.

In weakly subjects with poor breathing capacity and delicate lungs they may, with judicious practice, be the means of establishing a robust condition of health.

So far as stammering is concerned, and when not due to any exciting cause, which may be removed by treatment, these exercises may be the means of effecting a speedy and permanent cure.

As an instance of this, here is a case in point. A few months ago at the Cambridge Hospital, Aldershot, a recruit was brought to my notice who stammered so badly that it was deemed advisable by the medical authorities to discharge him from the service. I applied for permission to treat him, but was at first refused on account of the apparent hopelessness of the case. Ultimately, however, I gained the required permission, and having satisfied myself that there was no need for surgical or medical interference, gave him a course of the above exercises, combined with reading drill, under my personal supervision, for one hour every day. He very soon showed signs of improvement, and in a short time was able to read a paragraph from a newspaper without any difficulty either as "challenging" when a sentry, or "numbering off" on parade.

Another advantage to be gained is the increased expansibility of the chest. The greater the descent of the diaphragm the greater is the expansion of the lungs and chest walls. The lung power is therefore increased, as also is the amount of oxygen taken into the blood. The greater control a man has over his diaphragm, the greater control he has over his breathing, especially when extra demands are made upon the lungs, in the way of getting rid of noxious products of combustion. His powers of endurance must therefore be increased. On the other hand, in that form of breathing where, during respiration, the collar-bones are raised and the abdomen drawn in, there is imperfect aeration of the blood, and this may lead, as I have before pointed out, to venous congestion of the upper extremity.

This style of breathing may be seen at any time with bandsmen who play wind instruments. I have frequently noticed it at Aldershot, when on a Sunday I have watched the different regiments being played to church. Their faces are scarlet, the veins on the neck and temple are outstanding, and every time an inspiration is taken the shoulders are raised to a corresponding extent with the amount of fatigue. This condition might be easily obviated by a little attention to their uniform, so as to allow the breathing parts full play, especially at the neck and waist. A tight collar constricts the windpipe, and a tight belt and tunic have a restraining effect on the bellows.

In addition to this every wind instrument player should be instructed in the method of being able to produce a maximum amount of sound with a minimum expenditure of power. This, I have no hesitation in saying, can only be done by the means already described.

The same remarks would apply also to buglers.

The three recruits which I have brought with me to-day have been practising these exercises since the 10th of last January. On that date their chest measurements, which were taken by an officer of the A.M.S., at Aldershot, were as follows:—

	Min.	Max.		Expansion.
Cowland	32½	34½	+	2 ins.
Swetland	33	34½	,,	1½ ,,
Holmes	33¾	36¼	,,	2½ ,,

On the 13th February they were again measured with the following results:—

	Min.	Max.		Expansion.
Cowland	32¼	35¼	+	3¼ ins.
Swetland	32½	35¾	,,	3¾ ,,
Holmes	32	36¼	,,	3¾ ,,

In every instance there is a gain of chest expansion, which, considering the short period these exercises have been practised, tends to show the importance of this form of training.

The reason men are rejected for the army, so far as chest measurement is concerned, is because they neither know how to fill their lungs with air on the one hand, nor empty them on the other.

Give me any recruit who is healthy, but still does not come up to the required standard of chest measurement, and I will guarantee that in a few weeks, by means of the diaphragmatic drill I have shown you, that I will expand his chest to the necessary requirements.

My experience is, the younger the man the more satisfactory the results.

So far as my own experiences are concerned, I commenced practising these exercises about 10 years ago, at which time I

was completing a course of singing lessons. I experienced great difficulty in controlling my breath, especially whilst executing long passages, and frequently asked my master to give me instruction in the art of breath control, but he always replied, "As long as you breathe in the right place, and phrase correctly, you may take your breath how you like."

At that time my chest expansion was 2½ in., but on my subsequently employing the form of breathing I am now advocating, my chest gained corresponding strides in development, and at the present I have 6 in. expansion between my minimum and maximum. This measurement was accorded me, a short time ago, by two officers at Aldershot, on the occasion of my giving a brief demonstration on this subject at the military gymnasium.

To singers the subject of this paper is most important, but time will not permit me to dilate on my experiences, so far as this portion of the question is concerned. So I must reserve my remarks until I have an opportunity elsewhere of specially addressing musical people on the subject of breathing as applied to singing.